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Tenth Annual Report of the Rubber Research Scheme (Ceylon).

(First Annual Report of the Scheme established under Ordinance No. 10 of 1930.)

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TENTH ANNUAL REPORT OF THE RUBBER RESEARCH SCHEME (CEYLON).

(FIRST ANNUAL REPORT OF THE SCHEME ESTABLISHED UNDER ORDINANCE NO. 10 OF 1930.)

THE Rubber Research Ordinance came into force on August 1, 1930, and the Board of Management, at their first meeting held on December 5, 1930, decided to accept the offer made by the Executive Committee of the old Research Scheme to hand over the entire assets, liabilities, and staff of their organization, with effect from August 1, 1930. This offer was subject to confirmation by a general meeting of the subscribers to the old Scheme.

The Scheme continued to be financed from the funds of the old organization up to the end of December, 1930, for which reason the report for that year was presented to the subscribers of the old Scheme.

The present annual report, therefore, is the first issued by the Board of Management of the Rubber Research Scheme established and financed under Ordinance No. 10 of 1930.

Final Meeting of Subscribers to the Old Scheme.

An Extraordinary General Meeting of the Rubber Research Scheme (Ceylon), being the final meeting under the old organization, was held at Colombo on March 26, 1931.

The report of the Scheme for the year 1930, the report of the technical officers, and the report of the London Advisory Committee were accepted; together with the statement of accounts and balance sheet at July 31, 1930, audited by Messrs. Duncum, Watkins, Ford & Co., and those at December 31, 1930, audited by the Colonial Auditor.

The meeting unanimously confirmed the following resolution which had been adopted by the Executive Committee at a meeting held on October 24, 1930:—

> That the entire assets, liabilities, and staff of the old Rubber Research Scheme be offered to the Board of Management of the new Rubber Research Scheme, with effect from August 1, 1930, the date on which the Rubber Research Ordinance came into operation.

The meeting also approved of the assignment of the lease of the land at Nivitigalakele entered into by the Crown with the erstwhile Rubber Research Scheme (Ceylon), to the Board of Management of the Rubber Research Scheme as constituted under Ordinance No. 10 of 1930, and the transference of the leases of land held at Culloden from the Rosehaugh (Ceylon) Rubber Co., Ltd.

Transfer of Leases held by the Old Scheme.

A short Ordinance to empower the new Board to take over the leases of the Crown land at Nivitigalakele is under the consideration of the Attorney-General's Department; as is the question of the transfer of the leases entered into on behalf of the old Scheme with the Rosehaugh Company at Culloden.

Board of Management.

The following changes in the personnel of the Board took place during the year:—

Mr. C. E. Hawes resigned in February, 1931, and was succeeded by Mr. E. C. Villiers, M.S.C.

The Hon. Mr. A. F. Molamure resigned in July, 1931, and was succeeded by the Hon. Mr. D. S. Senanayake.

Mr. A. S. Collett resigned in March, 1931, and was succeeded by Mr. I. L. Cameron.

Mr. C. H. Z. Fernando resigned in March, 1931, and was succeeded by Mr. F. A. Obeyesekere, M.S.C.

Mr. D. C. Senanayake died in July, 1931, and was succeeded by Mr. James P. Fernando.

Meetings.

The Board met on six occasions, namely, on February 19, May 21, July 16, September 24, November 26, and December 10.

The London Advisory Committee held four meetings, namely, on January 30, April 24, June 26, and October 30.

The Technical Sub-Committee (London) held four meetings on the same dates as the London Advisory Committee.

Research Work in London and Scheme of Joint Research with Malaya.

The question of the continuation of research work in London formed the subject of discussion at successive meetings of the Board of Management. In view of representations from responsible quarters in London, a definite decision was deferred pending the consideration by Malayan interests of a scheme of joint research that had been formulated in London. The Chairman of the Ceylon Board also conferred with the Chairman of the Malayan Board of Management on the latter's way through Colombo.

As the result of a decision of the Board at a later meeting, the London Advisory Committee was informed that " although the Board did not wish to give the London Staff definite notice of termination of their services, unless some satisfactory working arrangement for joint research work could be arrived at by the end of January, 1932, Ceylon would not be in a position to continue her contribution to work in London after the end of April, 1932 ".

The Scheme of joint research was accepted by the Rubber Research Institute of Malaya in December, and the Board of the Ceylon Scheme agreed to vote for 1932 half the estimated expenditure of £2,800, but decided that an endeavour should be made during the year to obtain an assessment, on an acreage basis, of Ceylon's contribution towards future expenditure.

The constitution of a new Committee—to be known as the London Advisory Committee for Rubber Research (Ceylon and Malaya)—is under consideration.

Development of the Rubber Research Scheme.

A small Committee was appointed in February to take steps to ascertain what properties were available for purchase in different rubber-growing districts for the purpose of experiments in rejuvenation of old rubber areas. It was also decided to approach Government regarding the reservation of a piece of Crown land at Liniyawa for the purposes of the Scheme. The Committee reported that certain properties were available, but considered that the policy of the Board regarding future expansion should be defined before they could proceed further. An enlarged Committee was deputed to formulate a scheme for the development of research work and to inspect and report upon the Liniyawa Crown forest or any other available land. This Committee recommended that a developed estate be purchased for experiments in rejuvenation and that the Crown land at Liniyawa be definitely secured from Government. They submitted an outline of the nature of work to be carried out but considered that a detailed scheme of development should await the appointment of a Director.

At a later meeting, a deputation consisting of Messrs. J. D. Finch Noyes, C. E. A. Dias, F. H. Griffith, and I. L. Cameron was appointed to wait on the Hon. the Minister of Agriculture and Lands and urge the necessity for handing over the Crown land at Liniyawa for the purposes of the Research Scheme. The deputation, which was received on December 3, reported that the Minister was sympathetic towards their object, but had emphasized that a definite scheme must be formulated to show how the land was going to be utilized and how the income derived from the cess was to be spent. A scheme was drafted by the Estate Committee and submitted to the Minister on December 12, and formal application was made to the Assistant Government Agent, Kalutara, for the handing over of 566 acres of Crown land in the village of Liniyawa.

Staff.

Director.—The post of Director of Research was advertised in England and abroad and 23 applications were received. From these the Board made a selection of three names for consideration, and, after correspondence, has since (January, 1932) appointed Mr. T. E. H. O'Brien, Chemist and Chief Technical Officer to the Scheme, to be Director of Research.

Chemist.—Mr. T. E. H. O'Brien was on home leave from April 22, 1931, to January 17, 1932. His duties as Chief Technical Officer were carried on by Mr. R. K. S. Murray, the Mycologist.

Mycologist.—Mr. R. K. S. Murray's agreement with the Scheme terminated in September, 1931, but was temporarily extended, and he has provisionally accepted re-engagement, to date from his return from home leave in December, 1932.

Agricultural Assistant.—Mr. W. I. Pieris was confirmed in his post on June 1, 1931.

Provident Fund.—A Provident Fund scheme, applicable to the staff of both the Rubber and Coconut Research Schemes in receipt of a salary of Rs. 50 a month and above, was drawn up by Mr. C. W. Bickmore, Deputy Financial Secretary, and has been adopted by the Board. The Scheme provides for a monthly contribution by each member of 5 per cent. of his salary and a similar contribution annually by the Board, interest at 4½ per cent. per annum being payable from the funds of the Scheme.

Finance.

The main income of the Scheme was derived from the cess of ⅛ cent per lb. of raw rubber exported from the Island. The monthly collections were as follows:—

	Rs.		Rs.
January ..	22,948	July	12,678
February ..	17,406	August	10,436
March	16,566	September	11,072
April	12,409	October	15,404
May	10,899	November	13,092
June	14,984	December	12,735

The balance sheet at December 31, 1931, shows cash on fixed deposits and current account and cash in hand and in London amounting to Rs. 160,189.02, as compared with Rs. 90,405.19 at the end of 1930. From this balance the sum of Rs. 798.24 is earmarked for sundry creditors, as compared with Rs. 3,545.89 at the end of 1930, leaving a nett balance in the general fund of Rs. 159,390.78 to be carried forward to 1932, as compared with Rs. 76,664.62 brought in.

During the year a further sum of Rs. 10,160.86 was spent on the Experiment Station, Nivitigalakele, the development account for which now stands at Rs. 84,771.58.

The accounts of the Board are now audited by the Auditor-General. His certificate and report, together with the Income and Expenditure Account and the Balance Sheet, are annexed—pages 23 to 28.

Publications.

Handbook.—" Diseases of Rubber in Ceylon ", by Mr. R. K. S. Murray, A.R.C.S., Mycologist, July, 1931.

Quarterly Circulars.—Owing to shortage of staff it was only found possible to publish three numbers of the Quarterly Circular, the second and third issues being amalgamated. The following subjects were dealt with in these Circulars:—

Diseases of Rubber in Ceylon, 1930.
The Effect of Blanketing on the Plasticity of Crepe.
The Cause of Variability in the Plasticity of Plantation Rubber after Storage.
The Effect of Maturation on the Plasticity of Smoked Sheet.
Report of the Committee on Soil Erosion.
Further Sulphur Dusting Experiments against Oidium.
The Experiment Station, Nivitigalakele.
Budding Routine at Nivitigalakele.
A Review of the Work in London on the Plasticity of Rubber.
Diseases of Rubber in Ceylon, 1931.
The Influence of Oidium and Sulphur Dusting on Yield and Bark Renewal.
Notes on Budgrafting.

Leaflet.—Reprint of Mr. Lord's report on a visit to Malaya, Indo-China, Sumatra, and Java, March-May, 1929.

Bulletin.—No. 51—" The Curing of Sheet Rubber ", by Mr. T. E. H. O'Brien, M.S.C., A.I.C., Chemist and Chief Technical Officer.

The publications of the Scheme, excepting the handbooks, are being issued free of charge to Ceylon estates or planters who register their names at the beginning of each year. 144 applications were registered in 1931.

Progress of Work.

The progress of technical work carried out during the year is recorded in the reports of the London Advisory Committee, of the Chemist and Chief Technical Officer, of the Mycologist, and of the Agricultural Assistant, which are appended to this report.

W. YOUNGMAN,
Chairman, Board of Management,
Rubber Research Scheme (Ceylon).

JOS. I. GNANAMUTTU,
Secretary, Board of Management.

Peradeniya, March 31, 1932.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR 1931.

THE Committee and Technical Sub-Committee each held four meetings during the year.

During the year Lieutenant-Colonel J. Sealy Clarke resigned his membership of the Technical Sub-Committee as the representative of the Research Association of British Rubber Manufacturers. On his nomination Mr. B. D. Porritt, M.Sc., F.I.C., Director of the Research Association, was elected to the vacancy on the Sub-Committee. Lieutenant-Colonel Sealy Clarke continues to serve on the main Committee. A unanimous vote of thanks was passed to Lieutenant-Colonel Sealy Clarke for his services on the Sub-Committee.

Mr. A. S. Collett and Mr. C. E. Hawes (Ceylon Board of Management) and Mr. T. E. H. O'Brien (Chief Technical Officer in Ceylon) attended meetings of the Committee whilst in London. Mr. O'Brien also paid several visits to the laboratories and discussed with the staff various questions relating to the work in progress. Members of the staff accompanied him on visits to factories and to demonstrations of processes of interest to rubber producers. Visits to the laboratories were also paid by Dr. Tempany, Chairman of the Board of Management, Rubber Research Institute, Malaya, and by Dr. E. Rhodes of the Chemical Division of the Institute, to whom the scope of the work carried out in London on behalf of Ceylon was explained.

Following discussions between the Chairman and Dr. Tempany with a view to arranging a joint scheme for work in London on behalf of the Rubber Research Organizations of Malaya and Ceylon, a strong recommendation was forwarded to Malaya by the London Advisory Committee of the Rubber Research Institute that in order to secure continuation of the existing work at the Imperial Institute the Malayan and Ceylon Rubber Research Schemes should agree to contribute in equal proportions to the maintenance of the present staff and laboratories on the existing basis. It was suggested that this arrangement should be adopted for a definite period of three years from January 1, 1932, so as to allow time for the present world crisis to settle down and to afford ample opportunity of pursuing and consolidating a comprehensive scheme. These proposals were approved by the Board of the Rubber Research Institute of Malaya, and information was received at the close of the year that they had been accepted by the Board of Management in Ceylon for 1932 but that it is proposed to urge that *pro rata* contributions should be made by Malaya and Ceylon in future. The necessary steps for the amalgamation of the two London Advisory Committees are being taken.

Finance.

Expenditure incurred by the London Committee was £2,518. 8*s*. 1*d*. which included £105. 12*s*. 4*d*. in respect of apparatus, &c., purchased on behalf of the Ceylon Committee. At December 31, 1931, there was an unexpended balance in London of £43. 13*s*. 8*d*.

Staff.

Mr. F. L. Elliott resigned his post as Chemist on the staff of the Committee in May. The opportunity was taken to rearrange the duties of the technical staff, and a qualified junior officer and a boy have been appointed with a saving in expenditure. The staff in London now consists of G. Martin, B.Sc., A.I.C., F.I.R.I., W. S. Davey, B.Sc., A.I.C., H. C. Baker, B.Sc., A.I.R.I., L. L. Stewart, and F. J. Coker.

Investigations.

The principal cause of variability in plasticity has been established by a systematic study of the whole subject in London during recent years and the information obtained may have an important effect on the development of the rubber-growing industry. The investigation has shown that the soft rubber which is now sometimes produced accidentally is not likely to be of good quality, and has made it possible to suggest a method of preparing soft rubber by an economic process not detrimental to the quality of the material. Although the work is only in its preliminary stages two manufacturers (one British and one Continental) have already requested large-scale samples for trial. The determination of the cause of variability in plasticity has also suggested a method of preparing hard rubber which may be useful for sole crepe. In order that further progress may be made with the preparation of both soft and hard rubber, it is necessary for investigations now to be carried out in the East. The whole subject was discussed with Mr. O'Brien whilst on leave in this country and he has arranged to give attention to the various problems on his return to Ceylon.

The manipulative properties of plantation rubber are inferior to those of a number of alternative materials which can be used more economically and therefore find a good market although inferior to rubber in other respects. The most striking example of a successful alternative is afforded by the market in the United States of America for alkaline reclaimed rubber. Investigations are in progress to determine whether the advantages claimed for this material are justified and whether a form of rubber can be prepared which will obviate its use. The results already obtained indicate that the advantages of using reclaim are not so definite as claimed hitherto.

The work of improving the uniformity of Ceylon rubber outlined in last year's report was continued. The first step was to establish that fairly uniform rubber can be obtained for a long period from one group of trees, and this was concluded in 1930. It has since been established by tests on samples from the majority of estates that Ceylon rubber displays wide differences in physical, vulcanizing, and mechanical properties. The Board in Ceylon have been supplied with a list of estates from which samples showing abnormal plasticity were received and arrangements made for the supply of further samples from these estates. If the results are confirmed it is proposed that Mr. O'Brien should study conditions on the estates with a view to effecting improvements.

Preliminary experiments on rubber from well-known clones show that in some cases the rubber may not have satisfactory ageing properties. The samples were obtained from small quantities of latex and had to be prepared by special methods. The quality of clone rubber is obviously of considerable importance in connection with the selection of budded material in Ceylon, and a more intensive study of the subject will be made as soon as larger samples are available.

As in previous years the staff in London co-operated with the Chemist in Ceylon in the examination of a number of samples received in connection with his investigations in the Colony. Samples of latex preserved with potassium and sodium hydroxide, and of lipin prepared from hevea latex received from the Rubber Research Institute of Malaya, were also examined.

Co-operation was continued with the Research Association of British Rubber Manufacturers in the investigation of the possibility of preparing ebonite with improved properties. A joint meeting of the staffs of the Association and of the Committee was held at which work with features of common interest in progress at either station was reviewed.

The following reports were forwarded to Ceylon during the year:—

(1) The uniformity of rubber from individual estates.
(2) Variability of Ceylon crepe and sheet as regards hardness and amount of mastication required.
(3) The quality of rubber from proved clones.
(4) The effect of storage of plantation rubber for long periods.
(5) The preservation of latex with potassium and sodium hydroxide.
(6) The effect on the properties of sheet of treating latex with " percob " solution.
(7) The effect of paranitrophenol on the ageing properties of vulcanized sheet rubber.
(8) The effect of hevea latex lipin on the manipulation of rubber.
(9) The preparation of soft rubber.
(10) Fine hard Para rubber from Mr. C. E. A. Dias.
(11) The effect of conditions of storage on the hardness of rubber.
(12) The effect of soaking freshly-creped coagulum in boiling water.

The routine reports, such as the above forwarded from time to time by the London Advisory Committee, are necessarily somewhat technical in character. A special memorandum was accordingly forwarded to Ceylon during the year in which an endeavour was made to give in non-technical language a summary of the practical objects of the programme in London and its importance to the industry during the present crisis. For the same reason, in connection with the detailed investigations referred to in reports Nos. (1) and (2) above, which it was suggested should be published in the Bulletins of the Scheme, popular summaries were prepared for the Quarterly Circulars.

A paper by Mr. Martin dealing with " Certain Aspects of the Work of the Scheme in London " was read at the " International Congress for the Development of Applications of Rubber " held in connection with the International Colonial Exhibition at Paris. Considerable interest was shown in this paper and it was reprinted in the Bulletin of the Rubber Growers' Association, October, 1931.

Further information regarding the investigations is given in the appendix.

P. J. BURGESS,
Chairman.

J. A. NELSON,
Secretary.

Imperial Institute,
London, S.W. 7, February 4, 1932.

APPENDIX TO REPORT OF THE LONDON COMMITTEE, 1931.

1. *The Preparation of Soft Rubber.*—Previous investigations by the staff in London showed that rubber changes considerably in plasticity on keeping for six months in a dry atmosphere and that two factors are responsible, viz., (1) a spontaneous hardening in the absence of oxygen, (2) a softening due to oxidation. This investigation was continued during the year and it was found that rubber became much harder in the absence of moisture than in its presence, and that the softening due to oxidation is not greatly affected by the humidity of the atmosphere.

It is concluded from these investigations that most of the plantation rubber which happens to be soft and therefore easily manipulated owes its softness to oxidation. Attempts were accordingly made to prepare soft rubber by the addition of suitable oxidizing agents to preserved latex. It was found that mild oxidizing agents had little effect on plasticity and strong oxidizing agents ruined the quality of the rubber. It has been suggested that the technical staff in the East should carry out similar experiments with fresh latex.

An easily controlled and cheap method of preparing soft rubber from preserved latex without oxidation has been evolved and application made for a provisional patent.

Although not so important, the preparation of hard rubber is of interest in connection with the production of sole crepe. The storage experiments referred to above indicate that hard rubber can be obtained either by keeping rubber in a very dry atmosphere or by the addition to latex of substances which retard oxidation. The latter is more practicable and it has been suggested that experiments in the East should also be made on the addition of antioxidants to latex.

Reference was made in the report for 1930 to the soft rubber obtained by immersing the coagulum in boiling water. Further sets of samples prepared by this method were examined during 1931 and the previous conclusions were confirmed, viz., boiled coagulum will yield crepe of good colour even in the absence of bisulphite; the product is soft, slow-curing, and absorbs less moisture than crepe from unboiled coagulum.

As in the previous experiments the boiling process removed an appreciable amount of fatty acids. It is of interest that in similar experiments in London on preserved latex this effect was not observed. These acids are of importance in connection with the vulcanization of some mixings, but it has been found that the deficiency, if a constant feature, can be easily remedied by the addition of stearic acid with the other compounding ingredients. A detailed investigation of the process in the East is necessary in order to determine the most suitable procedure, and the cause of the removal of the fatty acids.

It is frequently stated in technical literature that the reason for using relatively expensive reclaimed rubber is to improve the manipulative properties of raw rubber. A preliminary experiment was therefore carried out to determine the precise effect of reclaim with a view to preparing a form of rubber possessing similar manipulative properties. The results obtained indicated that the improvement effected by reclaim is not so definite as claimed hitherto. An extensive investigation on a wide range of grades of reclaim was in progress at the end of the year.

2. *The Uniformity of Plantation Rubber.*—In the report for 1930 reference was made to the examination of samples of crepe and sheet from about 300 Ceylon estates in order to determine whether any of them are producing first-grade crepe or sheet markedly different from the average for the Island as regards quality and behaviour in manufacturing operations. The determination of the hardness of these samples was completed during 1931 and the masticating properties of the hardest and softest groups of samples were determined. It was found that some of these samples required about twice as much mastication as others. The smoked sheets were more uniform and on the whole a little softer than the crepes.

The results of hardness tests carried out in Java on a range of estate samples indicate that a similar variation in hardness occurs in estate rubber from Java.

Arrangements have been made with Mr. O'Brien to obtain further samples from those estates which have been supplied samples with properties markedly different from the average. If it is confirmed that these estates are producing rubber with abnormal properties it is suggested that a study should be made of the methods of preparation employed.

In the meantime the samples already tested for hardness are being examined as opportunity occurs as regards rate of vulcanization in a rubber-sulphur mixing, amount and acid value of acetone soluble material, and water absorption in an atmosphere of fixed humidity.

3. *Clone Rubber.*—In the case of trees yielding large quantities of latex the relation between the amounts of caoutchouc and accessory substances in the latex may be somewhat unusual. As these accessory substances have a marked influence on the manipulation and vulcanization and on the ageing of the raw and vulcanized product, the properties of rubber from high-yielding clones may differ in important respects from those of rubber from average estates. A preliminary examination was therefore made in London of the properties of rubber from well-known clones, most of which are now being propagated in Ceylon. Owing to the absence of large areas of mature trees, it was necessary to examine samples prepared in Java by the kindness of the Proefstation voor Rubber by special methods from small quantities of latex. Some of the samples were of excellent quality and it is evident that satisfactory rubber is furnished by some high-yielding clones. It appears unlikely that there is any correlation between the yield capacity of a tree and the quality of the rubber.

In view of its practical importance the investigation of clone rubber is being continued and extended.

4. *Co-operation in Experiments Initiated in the East.*—(*a*) It was previously observed that sheet treated with paranitrophenol to prevent the development of mould and dried in warm air is inferior in ageing properties to similar sheet dried in smoke. Preliminary experiments showed however that the paranitrophenol had a harmful effect on the ageing of air-dried sheet but not on smoked sheet and that in the absence of paranitrophenol the ageing properties of air-dried sheet were satisfactory. The experiment was repeated during the year and these conclusions confirmed. It was also found that the development of mould is retarded by drying in air at temperatures above atmospheric (100°F.) and that dipping the wet sheets in gambier solution improves the ageing properties of air-dried sheet in the absence of paranitrophenol and also decreases the tendency of the samples to become sticky on drying at 100°F.

These experiments were initiated by Mr. O'Brien in connection with his experiments on the most economical method of drying sheet rubber.

(*b*) A number of tins of latex preserved with (1) sodium hydroxide and (2) potassium hydroxide were forwarded to London by the Rubber Research Institute of Malaya in order to ascertain whether these materials could be used in place of ammonia for the preservation of latex, as fixed alkalis are cheaper and easier to handle in the tropics. The problems involved were discussed with the Research Association of British Rubber Manufacturers, as a result of which it was arranged to distribute some of the latex among rubber manufacturers and research organizations connected with other industries in which latex is in use or might find application.

A scheme was also drawn up for the examination of the remainder of the latex in the London laboratories of the Ceylon Rubber Research Scheme. It was found in these tests that caustic soda was not an efficient preservative of latex, but that caustic potash was very satisfactory. The rubber from the dried potash latex had remarkably good vulcanizing and ageing properties; rubber prepared from the latex by coagulation with acetic acid was no better in these respects than that prepared by the coagulation of ammonia-preserved latex. The evaporated potash latex was hygroscopic and would therefore be unsuitable for a number of purposes where ammonia-preserved latex is now used.

Of the samples sent to manufacturers and research organizations the latex preserved with potash was preferred in only one case to that preserved with ammonia and in this instance concentrated latex was required.

It is concluded that latex preserved with potash and latex preserved with ammonia could both be used in industry; they differ however in important respects and it is unlikely that one could be used to the complete exclusion of the other.

(*c*) A sample of a lipin compound isolated from rubber latex by the staff of the Rubber Research Institute, Malaya, was brought to the Imperial Institute by Dr. Rhodes when on leave in this country. In view of the interesting results obtained in Malaya regarding the effect on some of the properties of rubber of the addition of small quantities of this lipin, the staff in London carried out an extended investigation of the subject.

The conclusions of the research staff in the East were confirmed; in addition it was shown that the lipin had a valuable effect on the adhesive properties of rubber and on the vulcanizing properties of an accelerator mixing. The utilization of these advantages is dependent upon the development of a practical economic process in the East for the isolation of lipin bodies from latex or waste serum.

P. J. BURGESS,
Chairman.
J. A. NELSON,
Secretary.

February 4, 1932.

CHEMIST AND CHIEF TECHNICAL OFFICER'S REPORT FOR 1931.

Duties as Chemist and Chief Technical Officer were continued up to April 18 when the writer proceeded on home leave and charge of the laboratories was handed over to Mr. R. K. S. Murray. Mr. W. I. Pieris then took charge of the Experiment Station under the supervision of Mr. Murray. Owing to temporary depletion of staff attention was largely confined, during the period under review, to advisory correspondence, the work of the Experiment Station, classification of mother tree records, and various administrative duties, leaving very little time available for chemical investigation.

The following is a summary of subjects of interest which received attention :—

The Curing of Sheet Rubber.

In Chemist's report for 1930 it was pointed out that unsmoked sheet rubber containing paranitrophenol as disinfectant has unsatisfactory ageing properties and it was suggested that the inferiority was due to the presence of paranitrophenol. Examination of a further series of samples recently at the London Laboratories of the Research Scheme confirmed this view and showed that sheet air-dried at 100°F. had better ageing properties than the smoked sheet control prepared from the same latex whereas air-dried sheet containing paranitrophenol was distinctly inferior. Air-dried sheet (without paranitrophenol) which had been soaked in a 1 per cent. solution of gambier extract after drying, in order to remove surface stickiness, also had good ageing properties. There is thus no scientific objection to the production of unsmoked sheet as a marketable form of rubber if a suitable disinfectant can be found to replace paranitrophenol. In this connection tests will be made with Salicylanilide which has recently come into use as a disinfectant in the cotton industry. It is of interest to note that a large rubber manufacturing company which owns plantations in Malaya is proposing to equip several new factories for the production of unsmoked sheet and is already shipping the product from one factory. In this case the use of a disinfectant is not found necessary as the rubber is shipped direct from the estate to the factory.

During the year an estate in the neighbourhood of the laboratories constructed a smoke-house to the designs of the Research Scheme. The building has a capacity of 10,000 lbs. and is heated by one fire. Firewood consumption (rubber wood) amounts approximately to 1 " yard " of wood to $\frac{3}{4}$ ton rubber or 1 lb. of wood to $3\frac{1}{2}$ lbs. dry rubber. Ventilation was provided in accordance with the data worked out in the experimental smoke-house at the laboratories and has proved to be satisfactory. The design is considered suitable for general adoption on estates and arrangements can be made for inspection of the smoke-house by any one interested.

Samples for Examination at the London Laboratories of the Scheme.

The following samples were forwarded to the London Laboratories for examination:—

(1) Bulk samples of blanket crepe and smoked sheet from the same latex for investigation of the effect of storage on plasticity.
(2) Samples of blanket crepe coagulated with formic acid, sulphuric acid, and alum.
(3) Samples of smoked sheet prepared by village cultivators.
(4) Samples of smoked and unsmoked sheet with and without the addition of paranitrophenol.
(5) Samples of blanket crepe prepared from coagulum which had been soaked in boiling water before being creped.

Mother Tree Records.

The Research Scheme has continued to receive monthly records (submitted quarterly) from estates of the individual yields of a large number of potential mother trees. Consideration was given to the question of how to make the records readily accessible for comparing the merits of different trees and a book was devised for recording in graphical form each month the average yield per tapping, average yield per foot of tapping cut, and the height of the cut for each tree. All available records have been compiled in this form and the books are proving very valuable in selecting trees for testing at the Experiment Station. Generally speaking, an average of two ounces of rubber per tapping per foot of tapping cut is regarded as a high standard of yield and trees which yield less than one ounce per foot of tapping cut are rejected, but consideration is given to bark structure, consistency of yield, the situation of the tree, and similar factors. Mr. Murray dealt with the subject of yield records during the greater part of the year, and further particulars are given in his report. It is well to emphasize that records have so far only been received from a comparatively small proportion of the estates in Ceylon, and it is hoped that other estates will make a provisional selection of their high-yielding trees and forward particulars to the Research Scheme.

Test-tapping Budded Trees.

Test-tapping of trees budded with locally selected material was in progress on five estates during the year. In most cases the trees are only four years old from the time of budding and it is too early for the results to be of great value, but several clones have given yields comparable with those of well-known foreign clones at a corresponding age. A few budded and marcotted trees at the Experiment Station, Nivitigalakele, were also brought into tapping and are referred to in the Agricultural Assistant's report. The Research Scheme has not yet decided upon its policy regarding the extent to which test-tapping on estates can be supervised (in the case of estates which are willing to accept supervision) but in the meantime the officers of the scheme have co-operated with estates where test-tapping is in progress by advising on methods of tapping and yield-recording.

Experiment Station, Nivitigalakele.

The report of the Agricultural Assistant indicates that steady progress was made at the Experiment Station and that budding of the plots was completed as far as supplies of budwood were available. There was a material improvement in the percentage of budding successes, which is largely attributed to the fact that the stocks were manured a few months before budding, thus ensuring that they were in a state of vigorous growth at the time.

In view of the possibility that the Research Scheme would be opening new land in 1932, special attention was given to the preparation of planting material. A nursery of 1,000 seeds from the Tjikadoe seed gardens was laid down, also a larger nursery of unselected seed. Budwood from a number of high-yielding estate trees was established in the budwood nursery and other estate trees were pollarded with a view to providing budwood.

Visits to Institutions and Factories in England.

While on leave in England the opportunity was taken to visit the following institutions and factories:—

Imperial Institute (London Laboratories of the Research Scheme).
Rubber Growers' Association Headquarters.
Rothamstead Experiment Station.
East Malling Research Station.
Jeallots Hill Agricultural Research Station.
Boot and Shoe Research Association.
Cotton Industry Research Association.
Messrs. Callenders, Cable & Construction Co., Ltd. (Rubber Manufacture).
Messrs. Dunlop Rubber Co., Ltd. (Latex Development section).
Messrs. Davis Bridge & Co., Ltd. (Machinery manufacture).
Messrs. Joseph Robinson & Co., Ltd. (Machinery manufacture).
Messrs. Francis Shaw & Co., Ltd. (Machinery manufacture).
Messrs. Strickland & Co. (Shoe manufacture).
Bull Wharf (Storage of rubber).
Messrs. G. Scott & Co., Ltd. (Concentration of latex).
Messrs. Stubbin & Co. (Fish curing).

Visits and Advice to Estates, Correspondence, &c.

Visits were made to 2 estates for advisory purposes and to 6 estates in connection with experimental work. The Experiment Station, Nivitigalakele, was visited on 15 occasions. The Iriyagama Division of the Department of Agriculture, Experiment Station, Peradeniya, was visited with the Chairman of the Research Scheme. The Tea Research Institute Conference and the opening of the new laboratories was attended, also the Annual General Meeting of the Planters' Association and a meeting of the Estate Products Committee of the Board of Agriculture.

One meeting of the Board of Management of the Research Scheme was attended by invitation.

Inquiries were dealt with on the following subjects of interest:—

Manufacture, &c.—Export of latex; preservation of latex with caustic soda; concentration of latex; adulteration of latex; use of anticoagulants; coagulating tanks for sheet manufacture; hydrometers for ammonia and formic acid; smoke-house design; use of coke and coconut husks for smoking; rust, bubbles, reaper marks in smoked sheet; preparation of air-dried and partially smoked sheet; use of paranitrophenol in sheet manufacture; deterioration of sodium bisulphite; massing of lace crepe; discoloration of crepe; semivulcanization of crepe; objection of manufacturers to paranitrophenol in crepe; variation in thickness of sole crepe; manufacture of sole crepe by the Malayan method; new uses for rubber, &c.

Agriculture, &c.—Budding technique; manuring prior to budding; manuring budwood nurseries; season for budding in different districts; inducing dormant buds to sprout; waterproof budding tape; selection of planting material for budding and for isolated seed gardens; test tapping of budded trees; yields of foreign clones; identification of clones; influence of scion on stock; mother tree records; merits of various tapping systems; deterioration of old rubber areas; heavy tapping prior to removal of trees; desirability of resting during wintering period; selection of cover crops to suit various conditions; identification of cover crop seed; preparation of Adco manure, &c.

Correspondence, up to the time of the writer's departure on leave, amounted to 469 letters inward and 502 letters outward.

Visits to Laboratories.

The laboratories were visited by Dr. G. Hatton, Director of the East Malling Research Station, Professor E. C. Stakman of the University of Minnesota, Dr. H. N. Whitford of the Rubber Association of America, and a number of Superintendents of Estates.

Publications.

" The Curing of Sheet Rubber ", published as bulletin No. 51.

T. E. H. O'BRIEN,
Chemist and Chief Technical Officer.

Research Laboratories,
Culloden estate, Neboda, February 10, 1932.

MYCOLOGIST'S REPORT FOR 1931.

Duties as Officiating Chief Technical Officer was resumed on April 22 on the departure on home leave of Mr. T. E. H. O'Brien. From this date until the end of the year general supervision of the work at the Experiment Station, Nivitigalakele, together with the yield recording of mother-trees, was exercised and advisory work conducted on all subjects. In consequence of these additional duties the time available for pathological investigations was necessarily curtailed.

The Control of Oidium Leaf Disease.

In the Annual Report for 1930 a brief account was given of the first experiments to be undertaken on the control of *Oidium* by sulphur dusting. The results were promising but not entirely satisfactory, and it was possible to deduce various reasons for this lack of entire success. Special attention was directed to these points in a further series of experiments carried out on Kandanuwara estate during the wintering season of 1931.

A full account of these experiments was given in Rubber Research Scheme Quarterly Circular, Vol. 8, parts 2 and 3, 1931, and only the main results and conclusions will be recapitulated in this report.

As the result of applying a total quantity of 85 lbs. of sulphur (mostly " Flotate " Sulphur) per acre in six applications at intervals of 12-21 days, defoliation in the dusted field was almost entirely prevented. The difference in appearance between the dusted and control areas was exceedingly striking, and was illustrated in the article referred to above by photographs, and by comparative figures obtained from the examination and classification of the foliage of a representative number of trees selected at random in the two fields. These figures showed.—

(1) That the proportion of trees classed as severely or completely defoliated had been reduced by the treatment from 56 per cent. in 1929 to 9 per cent. in 1931, whereas in the control field the similar figure had risen from 51 per cent. to 76 per cent.

(2) The proportion of trees in the dusted field in which leaf-fall was absent or very slight was 80 per cent., as compared with 13 per cent. in the control field.

The total inclusive cost of the treatment worked out at approximately Rs. 11 per acre; it must be stated, however, that all the costs were proportionately high owing to the small area involved.

It is concluded that the more successful results obtained in 1931, as compared with previous experiments, are largely to be attributed to the earlier commencement of the dusting operations. In the later experiments the first application was made in December, 1930, at the first sign of virulent *Oidium* attack on the young leaves, and the disease was never allowed to obtain the mastery. Nevertheless, although defoliation was very largely prevented, " secondary "

attack on mature leaves was still severe in the dusted field, and it is probable that during the period of maximum virulence the period between successive applications should not exceed 10-12 days.

Although sulphur dusting can now be confidently recommended on severely affected estates as the result alone of the improvement in foliage and general condition of the trees, yield per acre must be the ultimate criterion by which to judge the value of the treatment. Yield records from plots in the dusted and control areas were started in March, 1930, and have been continued throughout 1931. The full results up to December 31, 1931, are published in Rubber Research Scheme Quarterly Circular, Vol. 8, part 4, 1931. They show that whereas the normal yield of the dusted area has been fully maintained, that of the control field shows a considerable decline in 1931 as compared with previous years. A comparison of the yields per acre in 1931 with the estate figures for yields per acre in previous years indicates that the sulphur dusting has been responsible for a comparative gain in yield of about 200 lbs. per acre. This figure must be accepted with a certain reserve since the comparison is not strictly valid, but it is nevertheless clear that, apart from the more permanent benefits conferred by the retention of a normal foliage, there is an immediate yield response which, under the conditions obtaining on Kandanuwara, is sufficient to cover the cost of the treatment with rubber selling at only 15 cents per lb.

In addition to the experiments on Kandanuwara, advice and assistance have been given to two estates, one in Matale and one in Uva, which have undertaken sulphur dusting on a relatively large scale.

An improved model of the " Dustejecta ", a dusting machine manufactured by Messrs. Drake and Fletcher, Ltd., was tested and a full report submitted to the manufacturers and the Ceylon Agents.

A series of laboratory tests was carried out to compare the particle size of various proprietary brands of dusting sulphurs. It was found that " Flotate " sulphur from the Kawah Poetih volcanic deposits in Java was the finest of the tested products, but it has the disadvantage that the minute particles tend to adhere together in agglomerates on account of the hygroscopic nature of the powder. It was shown that this hygroscopicity was due to the presence of free acid, and the proportion of acid present was determined. The acid was removed by neutralizing " in the wet " with sodium carbonate, and the resultant powder was entirely free-flowing and physically ideal for dusting purposes. Owing, however, to the hydrophobic nature of sulphur, it would be impossible to wash out the acid on a large scale, and tests were therefore made with a dry " mix " of sulphur and lime. It was found that by mixing freshly burned lime with " Flotate " sulphur in the proportion of 1 part to 10, the lime slaked itself with the moisture so that a dry free flowing powder was obtained. This powder remained dry on exposure to a damp atmosphere, and the " balling " tendency was largely overcome. It is possible that this alkaline sulphur may have advantages from a chemical as well as a physical standpoint, and field experiments to test this point will be carried out in 1932.

It is of interest to record that the evolution of small quantities of sulphuretted hydrogen by action of sulphur on the mycelium and spores of *Oidium* was demonstrated, and it is therefore possible that this toxic gas plays an important part in the fungicidal action.

Disinfection of Imported Budwood.

It was stated in the Annual Report for 1930 that immersion of budwood for five minutes in a 1 per cent. solution of copper sulphate was an effective means of killing fungus spores which might be present on the surface of the bark, but that conflicting results had been obtained as regards the harmful effect on the budwood of this treatment. Further work in co-operation with the Rubber Research Institute of Malaya has shown that different clones vary greatly in their susceptibility to damage by treatment with copper sulphate (and possibly

other disinfectants). The clone used for most of the experiments in Ceylon was found to be quite resistant to a treatment which was extremely harmful to the clone used in Malaya in similar tests.

The results have shown—

(1) That immersion for five minutes in a 1 per cent. solution of copper sulphate is too severe a treatment as a general disinfectant measure.

(2) That were it considered desirable to enforce disinfection of budwood on or before import, it would be necessary to test every individual clone separately with the proposed treatment.

These experiments have been discontinued owing to pressure of other work, and at the present juncture it seems neither necessary nor desirable to recommend the introduction of any measures which would restrict the importation into Ceylon of high yielding material. A full report on the subject was prepared for the consideration of the Board of Management.

The work on this subject has exemplified the value of close co-operation between institutes studying similar problems.

Control of Bark Rot.

A field experiment was conducted during the South-West Monsoon to test the value in the control of bark rot of a series of special tar emulsions prepared by the South Metropolitan Gas Company, London. Such an emulsion has the special value that it may be applied in a liquid form to dry or moist tapping cuts, and that in a few minutes the emulsion dries to form a firm waterproof film. This property should be an important advantage in wet weather when, for many days at a stretch, the cuts are often too wet for the ordinary greasy mixtures to be applied. Three emulsions were received containing tar acids as the disinfectant principle in the proportions 2 per cent., 1 per cent., and nil respectively. In the field experiment these were compared with a greasy mixture known as " Brunol ". The emulsions containing the tar acids, and the " Brunol ", gave very satisfactory control of bark rot as compared with untreated trees. The emulsions appear to be entirely satisfactory except that they are insufficiently stabilized for storage for any appreciable time in a tropical climate. A full report was prepared and submitted to the Board of Management, and it is hoped that the manufactures will be able to send more highly stabilized samples for further trial.

Bark Renewal Experiment.

An experiment was laid out on Nivitigala estate, with the co-operation of the Superintendent, to test the value of the application of mixtures of cow-dung, earth, and disinfectants to renewing bark. Details of the experiment will be given when results become available.

Yield Recording Mother Trees.

A considerable amount of correspondence has been held with estates in connection with yield records of prospective mother-trees. All available information has been collected regarding trees already in our books, and an attempt has been made to extend the scope of this work. Unfortunately a number of estates which were formerly sending in yield records have ceased tapping during the year, and although records of new trees have been commenced, the total number of trees from which records have been received during 1931 shows a decline as compared with 1930. Particulars have been received of 152 new trees from 15 estates, and the total number of trees of which records were kept during the whole or part of 1931 is 524 situated on 39 estates. Yield records are measured on the estates in ounces of dry rubber, and the figures sent to the rubber Research Scheme on quarterly return forms. The average yield per Rubber Research Scheme on quarterly return forms. The average yield per plotted graphically in special books designed for the purpose.

Visits were paid to 19 estates in order to examine high yielding trees, check methods of yield recording, and take bark samples and other particulars. The Agricultural Assistant also visited 11 estates in this connection. Where possible budwood was taken from promising trees for multiplication in the budwood nursery at the Experiment Station. Material from 68 such trees was taken, exclusive of clones under test in the clearings. 151 high yielding trees were pollarded in 1931 with a view to providing budwood for future testing. Provision has therefore been made for budwood to be available in 1932 from 219 new Ceylon clones.

Experiment Station, Nivitigalakele.

General supervision of the work at the Experiment Station was exercised as from taking over duties as officiating Chief Technical Officer, and on an average 5-6 visits were paid to the station each month. A full account of the progress of work at the station is given in the Agricultural Assistant's Report.

Advisory Work, &c.

Advisory work on all subjects was conducted as from April 22.

Visits were paid to 28 estates in an advisory capacity, and, where necessary, full reports submitted for the information of the superintendents and agents. The total number of estate visits was 55 apportioned as follows:—

Advisory only	24
Inspection of high yielding trees only	15
Advisory and inspection of high yielding trees	4
Experimental work	12
	55

In addition, visits were made to the Central Experiment Station, Peradeniya, and the Tea Research Institute, St. Coombs. Five meetings of the Board of Management and one meeting of the Estate Products Committee were attended by invitation.

The total number of specimens and inquiries dealt with was 263 apportioned as under—

Mycological specimens and inquiries	130
Agricultural inquiries	89
Manufacturing inquiries	44
	263

Correspondence has been held with the Rubber Research Institute of Malaya on various subjects, and thanks are due to the Director for much valuable assistance in dealing with certain inquiries connected with manufacture.

Total correspondence, including letters and other documents, amounted to 1,064 inward and 1,392 outward.

Visits to Laboratories.

The laboratories were visited by a number of agricultural workers passing through Ceylon, and by approximately 50 estate superintendents.

Publications.

(1) Diseases of Rubber in Ceylon, 1930.—Quarterly Circular, Vol. 8, part 1.

(2) Report of the Committee on Soil Erosion (Review).—Quarterly Circular, Vol 8, parts 2 and 3.

(3) Further sulphur dusting experiments against *Oidium*.—Quarterly Circular, Vol. 8, parts 2 and 3.

(4) The influence of *Oidium* and sulphur dusting on yield and bark renewal.—Quarterly Circular, Vol. 8, part 4.

(5) Notes on budgrafting.—Quarterly Circular, Vol. 8, part 4.

(6) Diseases of Rubber in Ceylon, 1931.—Quarterly Circular, Vol. 8, part 4.

J. N. 19356 (5/32)

Summary of Weather Records at Culloden Laboratories.

	1931.	1930.
Rainfall	142·290″	158·24″
Highest monthly rainfall	21·87″ (May)	45·725″ (May)
Highest daily rainfall	4·55″ (May 3)	6.66″ (May 30)
Highest shade temperature recorded (day) .	95·1°F (March 1)	94·0°F (March 23)
Lowest shade temperature recorded (day)..	76·1°F (May 4)	74·7°F (May 6)
Lowest shade temperature recorded (night)	69·2°F (Jan. 30)	66·3°F (Jan. 22)

R. K. S. MURRAY,
Mycologist.

Rubber Research Scheme Laboratories, Culloden,
Neboda, January 21, 1932.

REPORT OF THE AGRICULTURAL ASSISTANT FOR 1931.

THE temporary appointment of the Agricultural Assistant for six months from the beginning of August, 1930, terminated at the end of January, 1931. It was extended from February to May, 1931, and from June 1, 1931, the appointment has been confirmed.

General supervision of the experimental and field work on the Experiment Station at Nivitigalakele was maintained under the direction of the Chief Technical Officer of the Rubber Research Scheme until April, when, on the latter's departure on furlough, the station and its accounts were taken charge of. Visits to estates for selection of budwood and particulars of high-yielders, and laboratory and office work have also comprised a portion of the duties during the year.

The Experiment Station.

The Clearings.—The 1926 and 1927 clearings though completed in 1930 have had a number of casualties among the budded stumps put out as supplies. 198 fresh supplies were planted out and the clearings were recompleted by the end of the year.

Considerable progress has been made in the 1928 clearing. The beginning of the budding season found, out of a total of 94 clones, 23 completed, 30 partly planted, and the balance 41 not started. Twenty-three out of the partly completed 30 have been completed, and out of the 41 not started 38 have been introduced and 7 completed. Further completion of clones has been limited by the insufficiency of suitable budwood, but measures have been taken to ensure an adequate supply for next season by pollarding mother-trees and by reproduction in the budwood nursery.

In view of the lack of uniformity of that portion of the 1928 clearing known as field 4A it was decided, before commencing budding operations on it, to divide the field into 4 quadrants more or less uniform within themselves and to have the clones represented in all four of them. In order to do this the field was mapped out on paper, and each terrace and tree was labelled and marked on the map. It was then divided as desired. Budding was commenced on this field. Sixteen clones were budded.

The budded position of the 1928 clearing at the end of December, 1931 (including results of December budding), was as follows:—

Plot.	Clone.	Total Plants.	Plants budded.	Percentage completed.	Plot.	Clone.	Total Plants.	Plants budded.	Percentage completed.
1A ..	MK. 3/2	.. 70	.. 70	.. 100	7 ..	MAD. 18	.. 25	.. 25	.. 100
2A ..	MK. 1/1	.. 71	.. 20	.. 28	8 ..	H. 140	.. 25	.. 25	.. 100
3A ..	KOS. 6	.. 65	.. 65	.. 100	9 ..	PB. 25	.. 26	.. 26	.. 100
1 ..	H. 24	.. 27	.. 27	.. 100	10 ..	DK. 19935	.. 28	.. 28	.. 100
2 ..	WG. 6278	.. 27	.. 27	.. 100	11 ..	WP. 24	.. 30	.. 30	.. 100
3 ..	DK. 5315	.. 25	.. 25	.. 100	12 ..	PB. 23	.. 27	.. 27	.. 100
4 ..	H. 82	.. 29	.. 29	.. 100	13 ..	Control	.. 26	.. —	.. —
5 ..	ST. G. 40	.. 27	.. 27	.. 100	14 ..	DK. 1	.. 26	.. 26	.. 100
6 ..	DBK. 1	.. 25	.. 25	.. 100	15 ..	WP. 57	.. 30	.. 17	.. 57

Plot.	Clone.	Total Plants.	Plants budded.	Percentage completed.
16	DBK. 4	30	30	100
17	WP. 76	27	27	100
18	MAL. 44A	25	25	100
19	DK. 3513	26	26	100
20	ML. 1	28	28	100
21	ELST.2313/16	26	26	100
22	NAK. 1	25	25	100
23	ELST.2239/12	30	18	60
24	NAK. 3	28	27	96
25	WP. 25	22	22	100
26	NAK. 4	30	30	100
27	BS. 3	30	30	100
28	MADD. 3741	28	28	100
29	TAL. 4	29	28	97
30	MAD. 22	26	26	100
31	COD. 3	30	30	100
32	HUN. 1391	25	25	100
33	COD. 4	27	27	100
34	FR. 120	27	27	100
35	COD. 5	30	30	100
36	ST. G. 39	27	27	100
37	LBW. 37	25	25	100
38	MKV. 1	30	30	100
39	GL. 6	30	29	97
40	K. 1	27	27	100
41	HC. 28	28	28	100
42	K. 12	26	26	100
43	FR. 168	25	21	84
44	K. 11	29	29	100
45	RH. 9	30	26	87
46	BP. 1	29	11	34
47	RH. 10	26	26	100
48	BP. 8	30	30	100
49	RH. 15	27	25	92
50	BP. 21	26	25	96
51	HUM. 7/1	28	12	43
52	PAS. 226	25	23	92
53	GH. 47	25	25	100
54	CG. 37	29	28	97
55	GH. 50	26	19	73
56	TGK. 1/5	30	11	37
57	GH. 51	29	24	83
58	LBW. 108	28	27	96
59	HW. 5	26	—	—
60	MK. 1/3	29	29	100
61	LBW. 147	25	11	44
62	YOG. 11T	27	27	100
63	PAS. 338	26	24	92
64	YOG. 20Y	26	25	96
65	PANA. 34/5	25	14	56
66	AK. 843	26	24	92
67	EGT. 1	27	24	89
68	AK. 18775	26	23	88
69	EGT. 2	25	18	72
70	TEM. 6	29	26	89
71	TR. 4/6	30	28	93
72	TEM. 15	30	18	60
73	TR. 6/11	30	10	33
74	WP. 22	26	21	81
75	KEP. 3	25	10	40
76	COD. 2	25	25	100
77	KEP. 7	25	15	60
78	ST. G. 60	27	24	89
79	ST. G. 2843	27	27	100
80	HAP. 33	27	27	100
81	AMB. 1	26	22	85
82	AMB. 2	27	27	100
83	M. 52	27	11	41
84	CDG. 45	25	14	56
85	PB. 186	27	27	100
86	AK. 18910	26	12	44
87	GK. 1	27	7	26
88	GK. 2	27	1	4
89	GK. 4	27	7	26
90	Control	24	—	—

Budwood Nursery.

The pruning of overgrown stock plants and budwood in November, 1930, had resulted in a much improved budwood nursery in 1931. The budwood produced was on the whole excellent (except in a few cases where the trees had had to be left unpruned) and the old stock plants were observed to have thrown out robust young shoots for budding on to. Benefiting by the experience all stock plants as well as budded plants left unpruned in November, 1930, were cut back during October and November. 1931, and should produce a completely resuscitated nursery by 1932.

The chart of the budwood nursery showing each tree in relation to its clone and row has been revised to include all new clones introduced in 1931. The number of clones so introduced has been 106 and the total in the nursery at the end of December 227.

Budding.

The budding programme at Nivitigalakele was started on April 15 and was continued up to about December 20. The results as compared with 1930 have shown a distinct improvement and are tabulated below:—

	Plants budded.	Plants successful.	Percentage successful.
Field	1,480	944	64
Supply nurseries	1,423	1,003	70
Budwood nursery	744	406	55
Total for year	3,647	2,353	65

It is significant that the " successful percentage " of 64 in the field includes budding done during the earlier part of the year, *e.g.*, April to June, when poor successes were obtained. If the budding done between April and June is excluded the " percentage successful " from July to December, 1931, works out at 73 (*i.e.*, 793 successful out of 1,092), as compared with 54 per cent. quoted as the percentage successful from September to December, 1930.

The best results will be seen to have been obtained in the supply nurseries and this is mainly due to the excellent condition of the stocks.

In the budwood nursery budding has often had to be carried out on stocks not suitable for the purpose in an effort to complete the " groups " assigned to each clone. This chiefly accounts for the low " percentage successful ". Moreover poor budwood coming from unpollarded estate trees though rejected for field budding is often " tried " in the budwood nursery.

Experiments in connection with various budding practices have been carried out in budding 8-year old rubber at different heights with a tested clone; in comparing ringbarking and breaking stock at 3 feet after second examination as against cutting it down 6 inches above bud; in determining the comparative waterproof qualities of different makes of budding tape; on the relative merits of a stock flap cut to taper to a point and one cut square; and in the introduction of a " budlifter ", 2 inches long by $\frac{5}{8}$ inch broad, in place of one $1\frac{1}{2}$ inch by $\frac{3}{4}$ inch, in order to save wastage of buds—and their results have been recorded either in contributions to the Rubber Research Scheme Quarterly Circulars or in the monthly reports of the Agricultural Assistant.

Nurseries.

1,060 selected seed from the Tjikadoe seed garden in Java were purchased and planted. 877 of these germinated and were planted out in a separate nursery.

2,000 seedlings from ordinary seed were planted in nurseries to serve as stocks for the future.

Green Manures and Cover Crops.

Practically the whole station now presents a well established and in most parts a luxuriant ground cover. *Dolichos Hosei* (Vigna), *Centrosema pubescens*, and *Calopogonium mucunoides* form the bulk of the ground cover though *Puaraira pheseoloides* (*P. javanica*) is seen growing lustily in certain areas and is rich in humus. *Clitoria cajanifolia*, as one of the best erect cover plants and one of the easiest to establish, has been grown along the edges of platforms to bind the soil together.

Green manures have been pruned twice during the year and the loppings have been buried in pits cut along the terraces or forked in as green manure. Alternate Gliricidias along rows have been cut back to 6 feet to avoid overcrowding and overgrown Albizzias have been either removed or lopped.

Approximately 80 lb. of green manure seed of various species were sold to estates from surplus seed collected at the station.

Manuring.

All three clearings have been manured. The unbudded trees in the 1928 clearing were manured first, in February, in order to get the " stocks " into active growth before commencing budding, followed by applications to field 4A, the 1926 and 1927 clearings and that portion of the 1928 clearing already budded. In manuring the 1926 and 1927 clearings green cover-crop loppings were mulched in with the artificial fertilizer mixture. Most seedling nurseries have been given one or two doses, as required, of artificial fertilizer mixed with " adco " prepared on the station. Manuring of ninety-six 8-year old trees prior to utilizing them for a budding experiment, and selective manuring of 400 trees in the budwood nursery, according to manure available, was also done.

Test Tapping.

Test tapping of 8 budded trees and 28 stock marcots was commenced in October. Only trees over 16 inches in girth at a height of 3 feet were tapped. The highest yield obtained during the first month's tapping was from Marcot 52 which gave an average of 14.44 gms. of dry rubber per tapping over 12 tappings. The highest yield from a budded plant was from tree No. 98 which produced 3.62 gms. per tapping. The corresponding highest yields for December were obtained from Marcot 52 (19.95 gms.) and budded plant No. 199 (10.96 gms.).

It is of interest to mention that the budded plants were budded between May and November, 1927, and that the marcots were planted in September, 1927.

Weeding.

The task of keeping platforms clean-weeded and free from covercrops has entailed regular monthly weeding rounds at the estimated average expenditure of Re. 1 per acre per month. The Sub-Committee of the Board of Management of the Rubber Research Scheme, who visited the station in December, have revised the policy for 1932 and considered it unnecessary to keep the platforms clear—except a small radius round each tree—especially as the rubber is getting older. The weeding accordingly is to cost considerably less next year.

In addition to the regular rounds, two rounds of Mikania rooting were done and the spots were marked with small white flags for future guidance. *Imperata arundinacea* (illuk) has been very little in evidence except in two or three places along boundaries.

The eradication of *Mikania scandens* through the agency of *Cuscuta chinensis*, which grows as a parasite on it was tried experimentally in small plots. Under these conditions, where the Mikania was not allowed to spread beyond the plots, extermination of the Mikania by the Cuscuta was successfully effected, but Cuscuta does not appear to spread sufficiently rapidly to control Mikania under ordinary estate conditions. Cuscuta was observed to grow on certain of the cover crops but did not appear to damage them.

Pests and Diseases.

A certain amount of Corticium salmonicolar (pink disease) has been in evidence and necessary measures were taken to deal with it. During wet months the *Calopogonium mucunoides* cover was somewhat badly attacked by snails and had to be sprayed with 4-5-50 Burgundy Mixture. Mite *Phytophthora palmivora* and *Helminthosporium Heveae* (" birds eye spot ") have occurred from time to time, particularly in the nurseries, though not to a serious extent.

Instruction.

Courses of instruction in budding were given to 16 conductors and labourers from estates. According to the time each is able to spend on the station every effort is made to initiate them thoroughly into the science and technicalities of the process. After moderate efficiency is acquired practice-budding is provided for in the instructional nurseries, and the results of such work are examined in due course. Before a learner is sent back his work is inspected in person by a responsible officer of the Rubber Research Scheme.

Trained budders of the Rubber Research Scheme have been sent out to five estates, but this only in special cases, as no adequate provision has yet been made to meet every demand.

Demonstrations to superintendents and conductors have been given on numerous occasions.

Roads and Paths.

The motorable road branching off from the main approach road to Nivitigalakele and leading into the 1928 clearing by way of the 1926 clearing has been extended by about 200 yards.

Flights of stone steps have been built wherever access to a particular place was steep or difficult and have helped to make the already-existing paths more serviceable.

Two culverts of concrete pipes built in with cabook were constructed at two junctions on the main approach road, and the banks of the recently built bridge were reinforced with heavy wooden piles and stone paving as they were showing signs of crumbling down during heavy rains.

Buildings.

A bath room and ceiling were added to the conductor's bungalow and other minor repairs were carried out to buildings in general.

Labour.

The labour employed has been mainly Sinhalese, to suit the nature of the work at the station. The permanent Indian labour force has been reduced to four, which number exempts the station from acreage fees.

The Staff.

The staff have discharged their duties willingly and satisfactorily. They are :—

Mr. S. B. O'Neil, Conductor in Charge.
Mr. D. J. Anbiah, Clerk (at Culloden).
Mr. H. J. Fernando, Budding Conductor.
Mr. D. C. Kannangara, Budding Assistant.
Mr. Y. J. Chelliah, Budding Assistant.

Visitors.

Thirty-one visitors signed the " Visitors' Book ". A Sub-Committee of the Board of Management of the Rubber Research Scheme visited the station on December 8 to inspect it and consider the estimates for 1932.

Rainfall.

The raingauge at Nivitigalakele registered as follows :—

	1930. Inches.	1931. Inches.		1930. Inches.	1931. Inches.
January ..	6.43	11.96	September ..	14.45	15.66
February ..	5.42	3.06	October ..	29.61	5.44
March ..	6.77	9.30	November ..	10.76	20.32
April ..	16.28	8.80	December ..	3.10	10.39
May ..	38.94	23.10			
June ..	13.44	17.41			
July ..	3.87	22.18	Total ..	156.55	169.64
August ..	7.48	22.02			

General.

Work in staining microtome sections of rubber bark with Acetic-sudan 111 and mounting them for the microscope was carried out. By this method the latex vessel rows are stained crimson and brought into prominence against the ground tissue. Samples of bark containing 98 and 20 latex vessel rows respectively were thus prepared and forwarded to the Jubilee Exhibition of the Society of Chemical Industry.

Eleven estates were visited for budwood, bark samples, and particulars of high yielders. Bark samples were examined from 185 high-yielders belonging to 20 different estates.

Publications.

The Experiment Station, Nivitigalakele. (Rubber Research Scheme Quarterly Circular, Vol. 8, parts 2 and 3. and Tropical Agriculturist, August, 1931.)

Notes on Budgrafting—(Jointly with Mr. R. K. S. Murray—Rubber Research Scheme 4th Quarterly Circular for 1931).

W. I. PIERIS,
Agricultural Assistant.

Rubber Research Laboratories, Culloden estate,
Neboda, January 25, 1932.

REPORT OF THE AUDITOR-GENERAL.

Audit Office,
Colombo, March 31, 1932.

The Board of Management,
Rubber Research Scheme,
Peradeniya.

GENTLEMEN,—I HAVE the honour to report that the audit of the accounts of the Rubber Research Scheme for the year 1931 has been completed and have pleasure in forwarding the following documents duly certified:—

(*a*) Income and Expenditure Account for the year 1931.

(*b*) Balance Sheet as at December 31, 1931.

I.—INCOME.

2. The total income accrued during the year amounted to Rs. 177,424.37. It exceeded the estimate of Rs. 159,000 by Rs. 18,424.37 and the income of the previous year by Rs. 8,904.99.

3. *Cess Collections.*—The amount accrued for the year was Rs. 170,594.35 inclusive of the collections made by the Principal Collector of Customs during December, 1931, but received in January, 1932. The collections for the five months August to December, 1930, amounted to Rs. 92,604 and the comparative drop in the collections for 1931 was due to decrease in the quantity of rubber exported. The estimate for the year was Rs. 150,000 and the actual collection exceeded it by Rs. 20,594.

4. *Rent of Bungalows.*—The amount recovered during the year was Rs. 896.88. as compared with Rs. 1,796.57 recovered during 1930. The decrease was due to the fact that of the three bungalows one was vacant from May, 1931, till the end of the year as the occupant was away on leave and another bungalow had been given free of rent from June, 1931.

5. *Interest.*—The amount accounted for the year was Rs. 5,191.29, as compared with Rs. 2,189.36 for 1930. All interest due for the year has been calculated and brought to account.

6. *Sale of Publications and Subscriptions.*—The amount realized for the year was Rs. 598.82, as compared with Rs. 1,111.85 for the previous year. The decrease was due to diminished demand for books.

II.—EXPENDITURE.

7. The details of expenditure on Revenue Account are fully set forth in the Income and Expenditure Account. For purpose of reference the following particulars of the expenditure for the last three years in Ceylon and London are appended:—

	1929. Rs. c.	1930. Rs. c.	1931. Rs. c.
Expenditure in Ceylon ..	83,342 35	66,602 29	54,180 22
Expenditure in London ..	34,055 56	35,272 79	31,506 60
Expenditure in connection with Rubber Conference at Java ..	6,287 4	533 33	—
Depreciation	12,176 90	9,048 77	6,198 91

8. A statement showing the excesses and unspent balances on votes, with Secretary's explanation is given below. Sanction for the excesses has to be obtained:—

	Estimated. Rs.	Actual. Rs.	Savings. Rs.	Excess. Rs.
I.—Personal Emoluments—				
(*a*) Technical Officers ..	52,766 ..	29,105 ..	23,661 ..	—
(*b*) Secretary	4,800 ..	4,500 ..	300 ..	—
(*c*) Subordinate staff ..	7,386 ..	5,904 ..	1,482 ..	—
(*d*) Rent allowance and rents ..	2,095 ..	785 ..	1,310 ..	—
(*e*) Provident Fund ..	270 ..	— ..	270 ..	—
(*f*) Pensionary contribution ..	356 ..	356 ..	— ..	—
II.—Other Charges—				
(*a*) Laboratory	4,500 ..	1,340 ..	3,160 ..	—
(*b*) Buildings	3,415 ..	2,152 ..	1,263 ..	—
(*c*) Printing, stationery, and advertising ..	3,000 ..	3,237 ..	— ..	237
(*d*) Postages	1,500 ..	885 ..	615 ..	—
(*e*) Audit	500 ..	104 ..	396 ..	—
(*f*) General charges, books, furniture, typewriter, telephones ..	3,135 ..	1,529 ..	1,606 ..	—
(*g*) Travelling	11,500 ..	4,138 ..	7,362 ..	—
(*h*) Passanges	3,500 ..	— ..	3,500 ..	—
III.—Experiment Station ..	11,000 ..	10,306 ..	694 ..	—
IV.—Expenditure in London ..	35,167 ..	31,697 ..	3,470 ..	—
V.—Bonus and passages ..	10,000 ..	5,000 ..	5,000 ..	—
VI.—Depreciation ..	— ..	6,199 ..	— ..	6,199

Savings:

I. (*a*) Due to non-appointment of Director, Physiological Botanist and Geneticist.
I. (*c*) Due to non-appointment of proposed Laboratory Staff.
I. (*d*) Due to reasons under I. (*a*) and I. (*c*).
II. (*a*) Due to reduction of work.
II. (*b*) Economies.
II. (*f*) Due to the purchase of furniture and new typewriter being deferred.
II. (*g*) Due to non-appointment of new staff and reduced travelling.
II. (*h*) Due to non-appointment of new staff.
III. Economies.
IV. Economies.
V. Over-estimate.

Excesses:

II. (*c*) Due to unanticipated expenditure in advertising post of Director of Research (Rs. 159) and call for the registration of parties desiring the Scheme's publications (Rs. 105).
VI. Not provided for.

9. *London Expenditure.*—The figures have been compiled from the returns sent by the Department of Overseas Trade. Audited and certified statements of the accounts to the end of June, 1931, have been seen; those for the remaining period have not yet been received.

III.—Balance Sheet.

(*a*) *Liabilities.*

10. *Sundry Creditors, Rs. 798.24.*—So far as can be ascertained all outstanding liabilities on December 31, 1931, have been brought to account with the exception of the cost of audit for 1931 amounting to Rs. 173.98.

11. *Reserve Fund for Bonus and Passages.*—Of the sum of Rs. 10,194.68 which was set apart from this account on December 31, 1930, for payment of bonus and passages to two officers, Rs. 2,392.35 was not utilized as one officer did not avail himself of the passage provided for. This amount is now included in the Reserve Account which stood at Rs. 5,991.30 on December 31, 1930, together with the sum of Rs. 5,000 contributed by the Scheme towards this fund during the year. The only expenditure from the fund was the bonus of Rs. 1,103.25 paid to Mr. Murray. The balance of the account on December 31, 1931, was Rs. 12,280.40.

12. *Provident Fund, Rs. 175.*—This represents the contribution made by the Agricultural Assistant towards the Provident Fund from June, 1931, at the rate of 5 per cent. of his salary. The Provident Fund Scheme is intended to take effect from January 1, 1932, except in the case of staff officers whose contributions are to begin from the commencement of their new agreements. The Agricultural Assistant entered into his new agreement in June, 1931.

13. *Permanent Reserve Account.*—No addition has been made during the year to this account which stood at the end of 1930 at Rs. 46,550.

14. *Experiment Station Reserve Account, Rs. 84,771.58.*—This represents the total expenditure at the Experiment Station, exclusive of maintenance charges in respect of buildings and roads.

15. *London Plant Reserve Account, Rs. 6,483.70.*—This represents the increase in value placed on the London plant at a valuation in 1930.

16. *Saleable Books Reserve Account.*—The saleable books in stock have been valued at Rs. 4,630 and this amount is shown under Assets and *per contra* a Reserve Account for the full amount is shown under Liabilities.

17. *Surplus Account.*—The excess of revenue over expenditure during the year, exclusive of the expenditure on development of the Experiment Station, is Rs. 85,538.64. From this amount Rs. 10,160.86 being capital expenditure on Experiment Station and Rs. 5,000 being contribution to the Bonus and Passage Fund have been transferred leaving a nett surplus for the year of Rs. 70,377.78. When this is added to the amount brought forward from 1930 the total surplus on December 31, 1931, stands at Rs. 180,634.19.

(*b*) *Assets.*

18. *Land Acquisition, Rs. 984.07.*—This is a balance carried forward from the previous year. No expenditure was incurred during the year on this account.

19. *Buildings.*—The balance on December 31, 1930, was Rs. 50,247.24. Five per cent. of this amount was written off as depreciation leaving a balance of Rs. 47,734.88.

20. *Laboratory Apparatus.*—The balance on December 31, 1930, was Rs. 5,310.13. After writing off 25 per cent. of it for depreciation and adding Rs. 887.08 being expenditure during the year, the account on December 31, 1931, stood at Rs. 4,869.68.

21. *Water Supply, Rs. 2,080.02.*—The balance on December 31, 1930, was Rs. 2,216.69. The depreciation written off was 10 per cent. of this amount. The expenditure on this account during the year was Rs. 85.

J. N. 19356 (5/32)

22. *Furniture, Fittings, and Office Equipment, Rs. 7,329.61.*—The balance at the end of the previous year was Rs. 7,873.58. A sum of Rs. 787.35 was written off for depreciation and Rs. 243.38 was added being expenditure during the year. A test check of the articles was made at the inspections. I have suggested a complete verification by a Board of Survey yearly of the inventory articles.

23. *Development of Experiment Station.*—The expenditure under this head during the year amounted to Rs. 10,306.08. Of this amount Rs. 145.22 representing upkeep charges in respect of buildings and roads has been written off against Revenue, and the balance of Rs. 10,160.86 has been added to the figure of Rs. 74,610.72 at which the Development Account stood at the end of 1930 making a total of Rs. 84,771.58.

24. *Saleable Books, Rs. 4,630.*—A complete verification of the books in stock was made.

25. *London Plant Accounts, Rs. 9,316.67.*—The balance at the end of 1930 was Rs. 10,666.67 and Rs. 1,350 was written off for depreciation during the year.

26. *Advances: (a) Insurances.*—The relative policies have been inspected and the amounts carried forward in respect of the unexpired portion of the premia paid have been verified.

(*b*) *Telephone Rents.*—The proportionate amounts of the rents paid for the periods extending into 1932 have been calculated and brought to account under advances.

27. *Deposits.*—The sum of Rs. 25 represents amounts paid to the Post Offices at Peradeniya and Neboda as deposits for trunk calls and phonograms.

28. *Sundry Assets at Experiment Station, Rs. 55.77.*—This amount was in the hands of the conductor and was not verified. The balance in his hands on March 4, 1932, was verified by an officer of this department.

29. *Sundry Debtors, Rs. 14,102.64.*—Of this sum Rs. 12,735.24 was due from the Deputy Financial Secretary on account of cess collections made during December, 1931. This was received from him in January, 1932. Rs. 1,367.40 is the accrued interest to December 31, 1931, on Fixed Deposits which would mature during 1932.

30. *Cash Accounts, Rs. 160,189.02.*—Receipts for the amount lying in Fixed Deposits were inspected. The balance on Current Account was verified by reference to the Bank Certificate. In support of the balance in London certified returns of the Department of Overseas Trade were seen.

IV.—General.

31. The accounts were received quarterly and were examined in this office. The books and accounts kept at the office of the Rubber Research Scheme at Peradeniya were inspected on four occasions during the year. The books were checked in detail and the cash balances verified. There was one inspection of the Laboratory at Neboda and of the Experiment Station at Nivitigalakele and a verification was made of the inventory book, cash on hand, and labour.

I am, &c.,

O. E. GOONETILLEKE,
Auditor-General.

RUBBER RESEARCH SCHEME (CEYLON).

Income and Expenditure Account for the Year ended December 31, 1931.

Dr. *Cr.*

To, *Personal Emoluments* :—	Rs. c.	Rs. c.	By	Rs. c.	Rs. c.
Salaries of technical officers ..	29,104 91		Cess Collections received, January to November ..	157,859 11	
Salary of Secretary	4,500 0		Collections due for December ..	12,735 24	
Wages of subordinary staff ..	5,903 70				170,594 35
House allowance ..	785 22		Rent of bungalows ..		896 88
Pensionary contribution ..	355 50		Interest on Fixed and Current Accounts ..		5,191 29
		40,649 33	Sale of publications and subscriptions ..		598 82
Other Charges :—			Sundry receipts ..		143 3
Upkeep of laboratory ..	599 42				
Samples for Imperial Institute ..	375 40				
Dusting experiments ..	305 10				
Routine tests of chemicals ..	60 35				
		1,340 27			
Upkeep of buildings	1,126 66				
Insurance of buildings ..	298 50				
Water supply ..	280 36				
Upkeep of roads ..	446 58				
		2,152 10			
Printing and stationery ..	3,237 36				
Postages and telegrams ..	885 14				
Books and periodicals ..	700 30				
Transport and sundry charges ..	511 14				
Telephone ..	317 59				
Audit and accountancy ..	104 11				
Travelling expenses	4,137 66				
		9,893 30			
Experiment Station :—					
Upkeep charges ..	145 22				
		145 22			
Depreciation Written off :—					
Buildings ..	2,512 36				
Laboratory apparatus ..	1,327 53				
Water supply ..	221 67				
Furniture, fittings, &c. ..	787 35				
		4,848 91			
Expenditure in London :—					
Salaries of technical officers ..	25,651 7				
Secretarial ..	3,375 0				
Apparatus and chemicals ..	1,126 88				
Incidental expenses	566 56				
Gas and electricity	886 49				
Publications ..	90 84				
	31,696 84				
Add : Depreciation written off plant in London—£100	1,350 0				
	33,046 84				
Less Proceeds :—					
Sale of publications .. Rs. c. 20 58					
Bank interest 153 45					
	174 3				
	32,872 81				
Balance, being Cess Collections due for December	12,735 24				
		45,608 5			
		170,594 35			170,594 35

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet, December 31, 1931.

LIABILITIES.	Rs. c.	Rs. c.
Sundry Creditors :—		
Experiment Station outstandings ..	345 92	
Local accounts ..	452 32	
		798 24
Reserve Fund for Bonuses and Passages :—		
Balance on special reserve of Rs. 10,194·68 on December 31, 1930	2,392 35	
As per Balance Sheet, December 31, 1930	5,991 30	
	8,383 65	
Less Bonus paid to Mr. Murray ..	1,103 25	
	7,280 40	
Addition in 1931 ..	5,000 0	
		12,280 40
Provident Fund Reserve Account		175 0
Permanent Reserve Account :—		
As per Balance Sheet, December 31, 1930		46,550 0
Experiment Station Development Reserve Account :—		
As per Balance Sheet, December 31, 1930	74,610 72	
Expenditure Rs. c. on Development, January to December, 1931 8,725 81		
Rebuilding bridge .. 1,435 5		
	10,160 86	
		84,771 58
London Plant Reserve Account :—		
Additional value placed on plant in London on July 31, 1930 ..		6,483 70
Saleable Books Reserve Account ..		4,630 0
Surplus Account :—		
Balance of Income and Expenditure as per Balance Sheet, December 31, 1930	110,256 41	
Add Excess of Income over Expenditure for the year 1931	85,538 64	
Less amount transferred to Experiment Station Development Scheme	10,160 86	
	75,377 78	
Less amount transferred to Bonus and Passage Fund	5,000 0	
	70,377 78	
		180,634 19

ASSETS.	Rs. c.	Rs. c.
Land Acquisition Account :—		
As per Balance Sheet, December 31, 1930		984 7
Buildings Account :—		
	Rs. c.	
As per Balance Sheet, December 31, 1930	50,247 24	
Less depreciation written off ..	2,512 36	
		47,734 88
Laboratory Apparatus Account :—		
As per Balance Sheet, December 31, 1930	5,310 13	
Less depreciation written off ..	1,327 53	
	3,982 60	
Add Expenditure during the year ..	887 8	
		4,869 68
Water Supply :—		
As per Balance Sheet, December 31, 1930	2,216 69	
Less depreciation written off ..	221 67	
	1,995 2	
Add Expenditure during the year ..	85 0	
		2,080 2
Furniture, Fittings, and Office Equipment :—		
As per Balance Sheet, December 31, 1930	7,873 58	
Less depreciation written off ..	787 35	
	7,086 23	
Add Expenditure during the year	243 38	
		7,329 61
Development of Experiment Station :—		
As per Balance Sheet, December 31, 1930	74,610 72	
Add Expenditure during the year ..	10,160 86	
		84,771 58
Stock Account of Saleable Books ..		4,630 0
London Plant Account :—		
As per Balance Sheet, December 31, 1930	10,666 67	
Less depreciation written of—£100 ..	1,350 0	
		9,316 67
Payments in Advance :—		
Insurance and telephone rent ..		234 17
Deposits :—		
For telephone, as per Balance Sheet, December 31, 1930	20 0	
Deposit for Phonograms ..	5 0	
		25 0
Sundry Assets at Experiment Station :—		
Cash in hand ..	51 71	
Timber account ..	4 6	
		55 77
Sundry Debtors :—		
Cess collection for December and arrears ..	12,735 24	
Interest accrued on		